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Beech Utilization Series No. 7

Beech for Containers

by

David B. Cook

Northeastern Technical Committee
On the Utilization Of Beech

in cooperation with

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. of Agriculture

1953

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FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

- * Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)

BEECH FOR CONTAINERS

by

David B. Cook

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BEECH (Fagus grandifolia Ehrh.) is one of the most common hardwoods of the eastern United States. In the Northeast, it is found in every state and at all elevations from sea level up to the middle mountain slopes.

Beech is a component of many forest types, but it is most prominent in the northern hardwood association of beech-birch-maple. Because it has been less in demand than other species it grows with, there has been a tendency to leave beech when cutting other kinds of timber.

Being long-lived, enduring and aggressive, beech has not only held its ground but has pushed into the space left vacant by the cutting of other species. As a result the percentage of beech has increased, and continues to increase, in the forests of the Northeastern States.

The only economically sound way to get a heavier cut of beech is to find more or better markets where it can be sold. Two promising outlets are the basket industry and the makers of wire-bound boxes.

In both of these products, the basic wood material is a slat or stave of rotary-cut veneer. The things that make

beech difficult to handle as lumber are not of great consequence in these processes, and here its good points can be used to advantage.

THE CONTAINER INDUSTRY

The making of baskets is an ancient art. From time immemorial, men have used baskets for storing and shipping agricultural products, just as we do today; and for these purposes the basket is still the best container. It protects its contents from bruising better than the bag does. It is superior to paperboard containers because it provides better ventilation, does not come apart when wet, stays clean longer, and can be re-used. Filled, it is not so heavy and awkward to handle as the barrel. Empty, baskets nest tightly and so require relatively little storage space. The rectangular wire-bound box made of veneer slats has many of the same advantages.

New baskets are most commonly used for such perishable fruits and vegetables as berries, cherries, peaches, pears, and tomatoes; in most cases baskets and contents are sold as a unit. In re-use, baskets serve for almost every farm product, as well as for many other things. Second-hand baskets are normally in fairly brisk demand, for baskets have a long life and are not discarded until worn out.

Wire-bound boxes serve as containers for vegetables, meat, and dressed poultry as well as for a wide variety of industrial products. Ordinarily these boxes are discarded after one use.

In the Northeast, the basket industry produces six basic types of agricultural baskets from wood veneer: berry, market, and climax baskets, continuous-stave and export tub bushels, and hampers. In size, they range from $\frac{1}{2}$ pint to $1\frac{1}{2}$ bushels. Perhaps the most familiar types are the quart berry basket and the continuous-stave 3-peck basket. For the most part, they are made in fairly large plants with a nearly non-stop assembly-line flow from the log through to the finished baskets stacked in the warehouse.

Wire-bound boxes are made in a number of sizes, often to fit particular requirements. They are assembled by automatic machinery, stored and shipped as flat shooks.

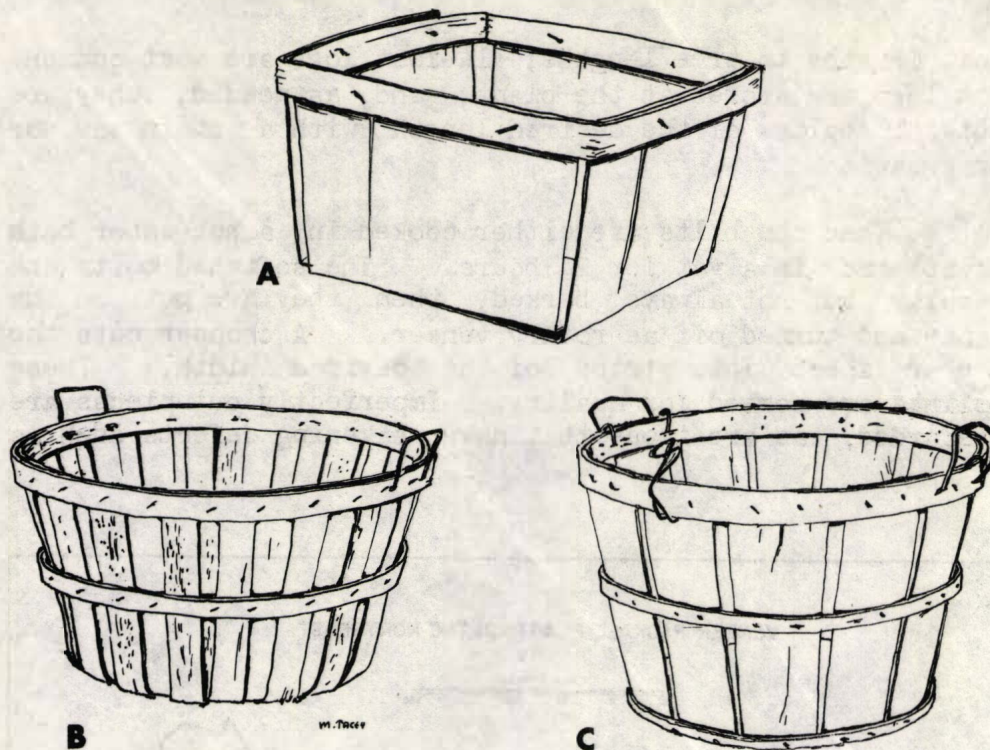


Figure 1.--Some of the basic types of baskets made from wood veneer. A, the berry basket; B, the continuous-stave basket; C, the export tub.

In the Northeast, basket-making is centered in New Jersey and New York. The volume of wood consumed approximates 50 million board feet a year, one-half in New Jersey, one-third in New York, the remainder scattered. Plants for the manufacture of wire-bound boxes are concentrated in New Jersey and Maryland.

For the highly industrialized Northeast, this is small business. But the economic importance of the industry is much greater than the volume of wood seems to indicate, not only because the industry is centered in and serves the packaging requirement of certain specialized and highly productive agricultural areas, but also because it is able to successfully use certain woods for which the demand is slow. Value added by manufacture is relatively high.

The process of manufacturing baskets is pretty well standardized. Logs come to the plant in anything from 6-

foot lengths to tree lengths; 14-foot logs are most common. The logs are stored at the plant, and, as needed, they are cut into bolts of the desired length with a chain saw or drag saw.

Then the bolts are either cooked in a hot-water bath or steamed in a vat for 24 hours. The softened bolts are usually but not always barked, then they are put on the lathe and turned off as rotary veneer. A chopper cuts the veneer sheet into strips of the desired width. These splints are sorted for quality. Imperfectly cut pieces are discarded, as are those that have weakening defects such as

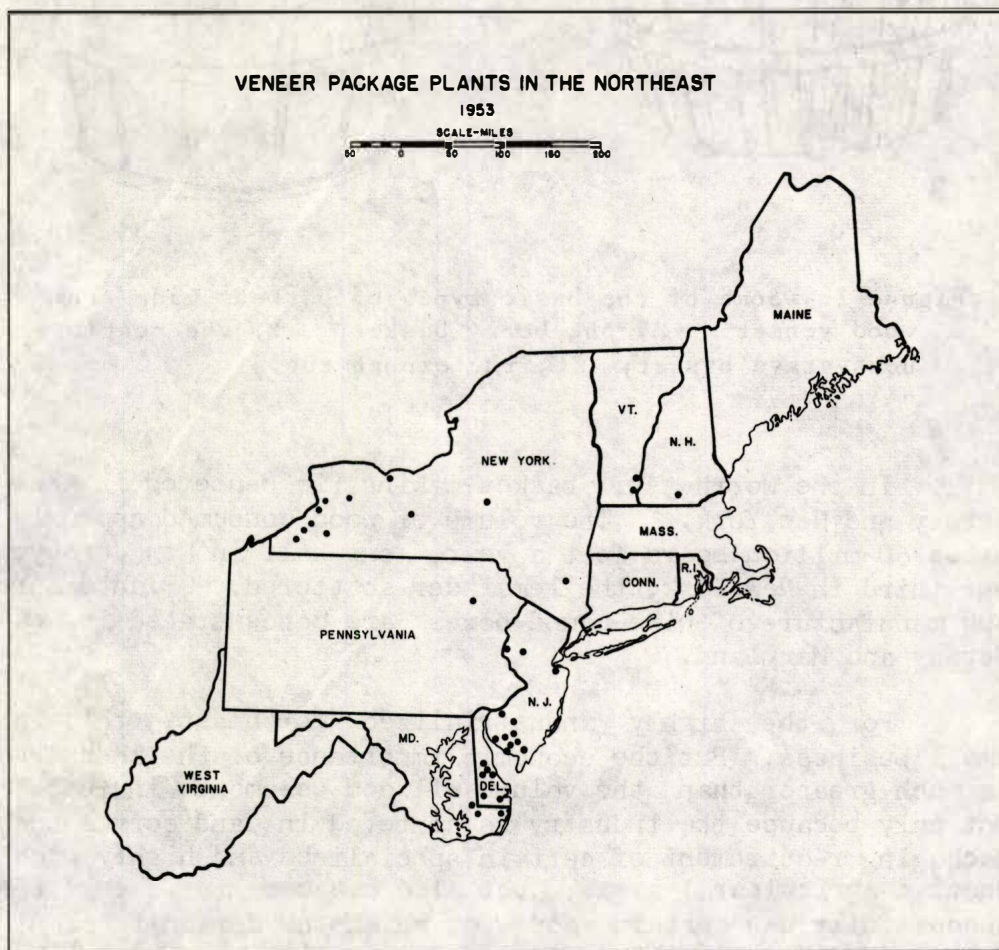


Figure 2.--The basket-making plants of the Northeast. The industry is most heavily developed in New Jersey and New York.

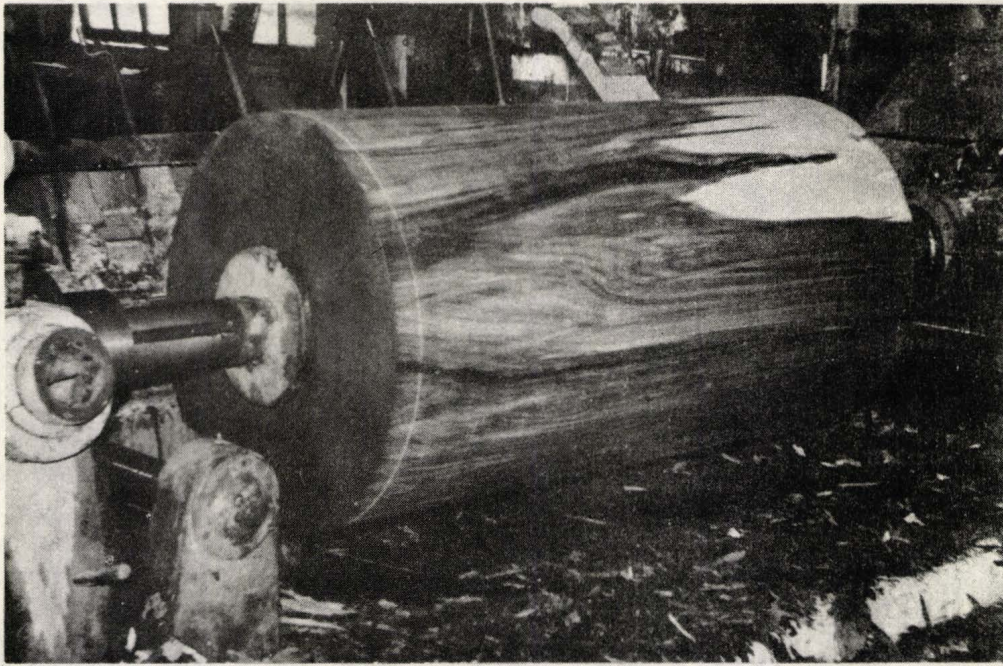


Figure 3.--A beech log on the lathe, being turned off into basket veneer at a basket factory in New York State.

knots, cross-grain and bird-peck, especially at the points where the splints are to be scored or bent.

These splints are fed into high speed machines that form and staple baskets and covers, attach handles and fastenings. Where solid bottoms are used--as in climax baskets and export tubs--they may be purchased from outside the plant or even outside the region, or they may be sawed from bolts or veneer cores. Baskets are air-dried, nested and stored under cover, ready for shipment.

The production of wire-bound boxes is essentially the same up to assembling. Veneer slats and small square pieces are fed into a machine that wires and staples the wooden pieces into a flat shuck that requires only folding to assemble into a box.

USE OF BEECH

A number of woods are used in the manufacture of baskets and wire-bound boxes: beech, maple, elm, gum, south-

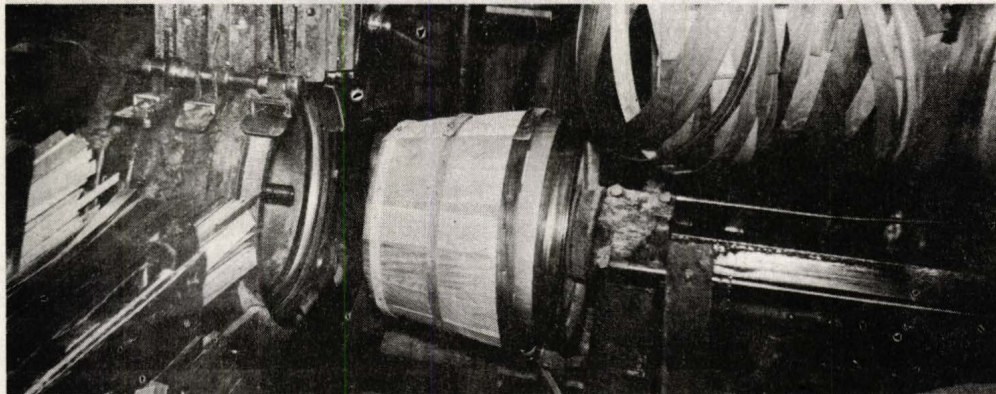
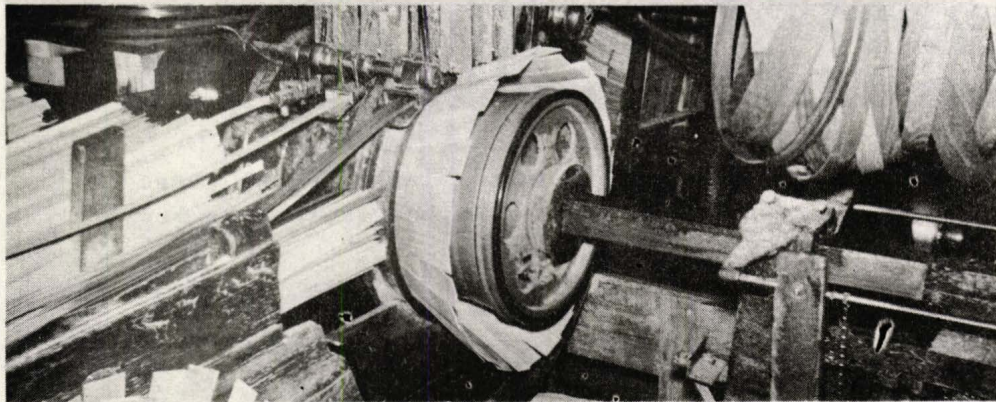
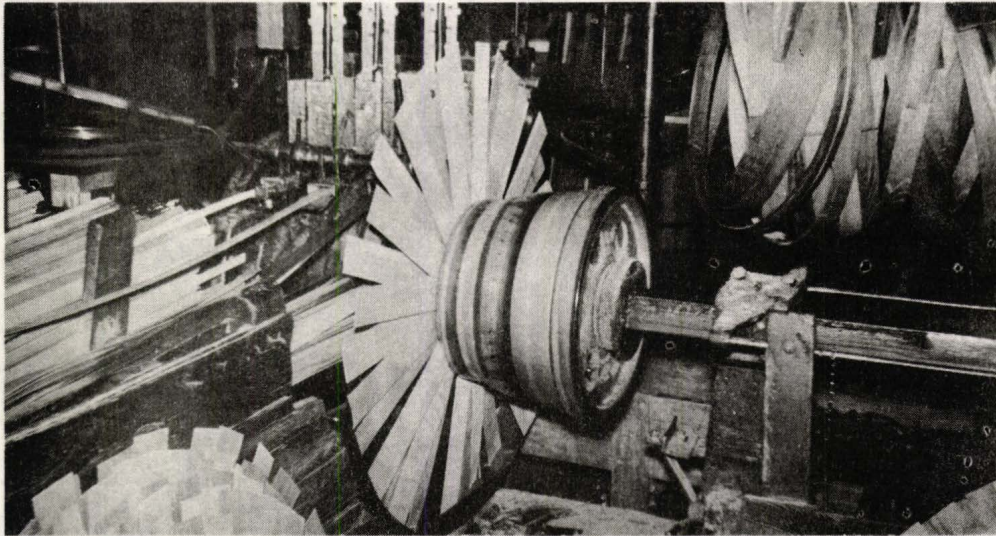


Figure 4.--The manufacture of a basket. Top, the stave assembly in place on the basket machine. Center, the machine forms the basket; note the bands ready to be fed in. Bottom, the finished basket, ready for drying and storage.

ern pine, and yellow poplar. Just which species are purchased depends as much on local availability and relative price as on technical qualities. In the southern part of the region--New Jersey and southward--gum and yellow-poplar are widely used; in New York and New England, beech, maple and elm.

Wherever logs of suitable quality are available, beech is the best all-round wood for basket making. It has more points in its favor, fewer drawbacks, and a wider range of usefulness than any other common species. Its utility could be considerably improved if greater care were taken in harvesting, storing, and manufacturing, to take fuller advantage of its good points and avoid its bad ones.

Price

To the container industry--a mass producer of low-priced items--cheap raw material is critically important. Among our common commercial woods, beech brings the lowest price, both as stumpage and as logs delivered to the mill, consistently and considerably below that of all other hardwoods except elm, which sells in the same price range as beech. At times when the demand for forest products is not strong, the spread may be even greater.

Availability

Beech is widely distributed throughout the region. In the northern part, it is an important component of the northern hardwood forest, where it is associated with hard maple, yellow birch, black cherry, ash, and basswood. Along the coast from New Jersey southward, where it grows with oak, gum, soft maple, and yellow-poplar, it is less common.

Generally the demand for beech has been poor. As a result, loggers have tended to leave it when they cut the more desired species. Proportionally, beech has increased as its associates have been more heavily cut.

Log Quality

Beech logs vary in quality from good to very poor. Because past markets for this species have been slow, loggers took only the best and biggest. Where cutting was light, much of the beech that remained was, by today's standards, fairly good timber. Where the cut was heavy, the re-

sidual stand was poor and has continued to go down in quality.

Beech has certain inherent qualities that make it especially useful in basket and box making. And some things that reduce the value of beech for lumber do not limit its use for container veneer.

Roundness In its best form, beech is as round as a barrel. This is a big advantage on the lathe, as it reduces waste in turning off narrow broken pieces from the outside of the bolt, gives the greatest amount of straight-grained and unbroken sheet, and so the highest proportion of usable slats or splints. Roundness is of greatest importance in the butt log, the biggest and usually the best in the tree. Some other important basket woods--notably hard maple and elm--often have swollen, fluted butts and sometimes ingrown seams of bark, so that a lot of wood, perhaps as much as 5 or 6 inches, must be turned off in small or irregular pieces before a solid cylinder is reached.

Sweep Especially when grown on steep slopes, beech trees tend to have sweep in the trunk; sometimes they are just plain crooked. For lumber, this is a serious fault, involving loss through heavy slabbing. Bucking into veneer bolts, which are seldom more than 4 feet long, permits the cutting of short straight pieces that give a relatively high yield even out of crooked logs.

Knots The limbs on beech tend to be both numerous and heavy, resulting in numerous big knots, especially in the upper logs. Beech logs may also contain many small black knots, as well as the big ones. Any knot causes an abrupt change in the direction of the grain, makes a weak spot in the stave or slat. This is most serious when it comes at a bend in round or bent-bottom bushels or at the scoring mark in other baskets. In box slats, knots and cross-grain are not so important.

Rot Many beech trees, especially those of low vigor, are infected with white heart rot. This is often spotty in occurrence, may be present in the middle of a log without showing on the outside or at either end. Butt rot is also frequent, especially in trees that started as root suckers or have been scorched by fire.

If a rotten or hollow heart is well centered and not more than 4 inches in diameter, an oversized lathe chuck may

be used and the sound outside wood turned off. Where rot is extensive, even an over-size chuck may fail to hold. Rot not only means loss of wood in an oversize core, but bits of rotten wood often break out and jam between the lathe knife and the nosebar.

Frost cracks. This is a very common defect in beech from some of the colder parts of the region. This defect is serious not only because it causes a break in the veneer sheet with every turn of the lathe, but also because frost-cracked bolts often split while being turned, resulting in loss of wood and delay in production.

Bark The bark on beech is smooth enough so that it picks up relatively little grit and sand to dull the lathe knife, something that cannot be said for rough-barked species such as maple and elm. After cooking, the bark peels off beech as easily and cleanly as any other species except elm. Peeling not only removes the grit, but saves turning off a lot of waste. This means a consequent increase of production from the lathe.

Checking Beech has a strong tendency to check. Logs that have been left out in the sun for only a little while will split badly at the ends. When the bark has been knocked off--and even sometimes when it appears to be unbroken--checks will develop along the sides. Such surface cracks may cause the veneer sheet to break along the grain.

Wood Characteristics

Texture The wood of beech is quite uniform in texture, with no conspicuous grain. It turns well on the lathe. If properly preheated (to 175° F.), it yields a tight veneer with little picking. Beech makes a tough, smooth stave that bends and staples well. Elm, which is very tough and pliable, makes the best basket bands, with beech rating a close second.

Hardness Beech is a little softer than maple, birch, or elm, harder than gum, pine, or yellow-poplar. No trouble has been reported in stapling beech on automatic basket machines. But boxmakers have had difficulty with beech being so hard that the machine had trouble driving and clinching the binding wires to the end slats of the shook. This can be overcome by using a slightly harder wire or by using end slats of softer wood.

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Color The sapwood of beech is white, the heartwood light reddish-brown. It makes a basket or box of a faintly brown color, lighter than elm but darker than maple. It never shows mineral streak, as do maple and yellow-poplar. While the very light color of maple baskets may improve the appearance, there has never been any discrimination against the faintly brown color of beech.

Taste Beech has neither taste nor smell; so it can be
& smell used safely in all sorts of containers for perishable foods.

Shrinkage Shrinkage in beech is considerable, especially across the grain. Since baskets are assembled from wet staves, shrinkage causes them to open up in drying. This does no harm in agricultural containers where a liner is used, but it is a real problem in berry baskets. These are cut from a single wide strip, have no overlap and so tend to open up at the corners. It is for this reason that yellow-poplar, with less shrinkage, is most widely used. But it has been found that a satisfactory berry basket can be made from beech by cutting the wet slat somewhat oversize, to allow for shrinkage.

Metal Beech is a woodland tree. It is seldom saved for shade, rarely grows along fence-rows, cannot be tapped for sugar. Consequently, it almost never has metal hidden in it to ruin the lathe knife. Elm often contains fencewire, nails, and hooks; and sugar maple is notorious for having metal spiles in the butt.

WHAT CAN BE DONE IN THE WOODS

In the wooded areas of the Northeast--and particularly in Pennsylvania, New York, and central New England--there is a tremendous amount of beech timber, and the proportion of beech is increasing. To reverse this trend, the forester should try to mark beech for cutting just as heavily as the market will permit.

It is better to get a beech tree--and especially a poor beech tree--cut and out of the forest at a very small profit or even at no profit at all, than to let it stand and occupy growing space that might better be used for more valuable trees. On the other hand, there is no sense in indiscriminately cutting small, sound, well-formed trees just because they are beech.

Basket and wire-bound box plants offer one of the best markets for beech, but they must have logs of a size and quality suited to their needs and processes. Greater care in the woods in preparing logs for this market will make them more useful at the plant and so, easier to sell. Beech is one of our lower-priced species and this is a considerable advantage to the manufacturer. Good preparation in the woods costs no more but does make the logs more desirable.

The logger should be careful in getting his beech trees down so as not to split either the butt by too small an undercut or the top logs by dropping the tree too hard over rocks or other objects. Splits due to careless falling cause the same sort of loss as do heavy checks or frost cracks.

Careful attention should be paid to measuring log length before bucking. Basket and container plants often specify logs of lengths different from those specified by sawmills. The lengths called for are those from which veneer bolts can most economically be cut. The delivery of logs of other than the specified lengths results in wasteful cutting up and trimming. The logger should be careful to buck his logs to the length asked for by the purchaser.

The smallest log that can be efficiently turned on a veneer lathe is 12 inches in diameter--14 inches would be a better minimum size. Smaller logs should be diverted to other uses, such as ties, pulpwood, and small dimension stock.

Logs showing rot, frost cracks, or numerous or big knots are wasteful to process for container veneer. Hauling them to such a plant results in the delivery of wood that not only cannot be used but is costly to dispose of. Such logs should be sent to some other industry that can use them to better advantage.

When bucking, the cut should go straight and square and all the way through, and not tear or break off the last inch or so of wood, as so often happens when the top hangs free. Even a small break-off at the end of the log will result in a number of staves or slats being short and so going to waste. At the factory, the dragsaw man can cut a crooked or partly defective log to better advantage than can the logger out in the woods. Therefore, logs should be deliv-

ered in the longest practical lengths, even though such logs are crooked or show a little decay.

Wherever possible, logs should be brought out of the woods with an arch or on a sled. Ground skidding tends to knock off patches of bark and to fill the bark with grit.

Because beech bark shells off upon drying and because the wood so exposed may check badly, logs should not be left in the woods or on a cold deck any longer than necessary, particularly in summer.

WHAT CAN BE DONE AT THE PLANT

When beech logs have been delivered to the mill, they must be stored until needed; and it is here that much good wood is needlessly wasted. All too often beech logs are left scattered around the yard, just as they were dumped off the truck. Or they are piled, but without any protection from sun and wind. This results in excessive drying, shelling-off of the bark, and severe checking. Improper storage also leads to increased losses from decay and insect attack.

The best storage for beech logs, especially in summer, is in water. If this is not practical, large close piles are better than small piles or rough-and-tumble heaps. Consideration should also be given to the use of end-coatings, to retard checking. Under no circumstance is there justification for leaving the logs lying around one-deep in direct contact with the ground. For a more detailed report on this important matter, see "Storage of Beech Logs and Bolts in the Northeast," an earlier publication in this series.

Beech bolts are softened for veneering by being steamed under hoods or cooked in vats of hot water. Heat is supplied by waste steam from the plant's boiler so that more steam is available at night than when the plant is in operation. Consequently temperatures fluctuate considerably.

Investigations on the veneering of beech indicate that a uniform temperature of 175° F. all the way through the log is best and that any great variation either up or down reduces the quality of the veneer sheet. Greater care in heating bolts to proper temperatures would result in a more uniform sheet. This is discussed in "Beech for Veneer and Plywood," another publication in this series.

S U M M A R Y

In the Northeast, beech is an excellent wood for baskets and wire-bound boxes. It is widely distributed, abundant, and readily available through most of the region. Because it is seldom in brisk demand for factory lumber, the price is among the lowest for the important commercial species.

Beech logs are often better in quality than are many of the other species used for baskets and boxes. Logs, especially butt logs, tend to be rounder than those of maple and elm. The smooth bark does not fill up with grit. Beech rarely contains iron.

Some of the disadvantages of beech can be reduced by more skillful and more careful handling, from stump to lathe.

The technical properties of beech wood make it especially well suited to basket and wire-bound box-making. It turns well, gives a high yield of tight veneer, makes a tough, pliable, bright stave or slat.

For best results, the logs should be of suitable quality and correct length. They should be carefully handled in the woods and properly stored at the mill. Preheating should be done at the right temperature. The handling of the veneer presents no special problem. Baskets and boxes of beech are readily accepted by the trade.

As one basket-plant superintendent put it: "I'd like to stock the yard with 80 percent beech; 20 percent elm, for bands. If I couldn't have elm, I'd take all beech."

- * Chemistry and chemical utilization of beech.
Management of beech.
Beech availability and supply.
Present markets and uses for beech.
Methods of logging beech.
Seasoning of beech.
- * Storage of beech logs and bolts.
Machining of beech.
Milling of beech.
- * Gluing techniques for beech.
- * Steam-bending of beech.
Preservative treatment of beech.
- * Beech for flooring.
Beech for furniture.
Beech for turned products and novelties.
- * Beech for veneer and plywood.
Beech for fuel and charcoal.
Beech for cross ties.
- * Beech for containers.
Pulping and defiberization of beech.
Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; A. H. Bishop, State University of New York, College of Forestry; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the "working committee" that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

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